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ABSTRACT

This paper presents a nontraditional definition of competency and describes in detail a comprehensive model for the development of competency-based curricula based on that definition. The model was developed through the anasynthesis procedure and was validated through application in the development of competency-based curricula for three programs at the University of Minnesota. A flow chart of the model's seven major components and a detailed outline of its subprocedures are presented, and alternative strategies for accomplishing each components are discussed. (JG)

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A General Model For Competency Based Curriculum Development

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by

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While the model was being finalized the author was on the faculty of the Departments of Educational Administration and Psychoeducational Studies Special Education Programs, and Co-Director of the Special Education Administration Training Program at the University of Minnesota, Twin Cities Campus © 1975 Daniel J. Dobbert

This paper is published with greater depth including a full systems model and simulation in the book Systems Engineering of Education II: Application of Systems Thinking to the Administration of Instruction, Education and Training Consultants: Los Angeles, CA, 1976.

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INTRODUCTION

The in word of today is competency based (CB) education. Lacking though is a concise generalizable model for the development of com-based programs. Also, lacking is a rigorous definition of competency which could serve as the criteria for judging whether statements are in fact competency statements. To those ends this paper addresses itself.

Historical Background

This model was initially developed during the late summer and fall of 1973. The purpose was to develop a model for the development of educational programs which would be competency based. Refinement over the next two years has resulted in the model presented here.

Development has been based upon a definition of competency which departs from the traditional. That tradition has equated performance - based and competency-based with objectives or goal oriented instruction (5)(10). The terms competency and performance have been seperated and defined by AACTE as being seperate (4). To clarify the concept, the competency definition utlized for

building the model presented here was refined and is presented as follows:

Competency is an intellectual, attitudinal, and/or motor capability derived from a specified role and setting, and stated in terms of performance as a broad class or domain of behavior. It can be analized and subdivided into one or more terminal performance objectives. Assessment must be holistic and conducted in an enviroment simulating the real world setting and role in which performance is expected to take place and from which the competency is derived. Performance of the competency in such a situation is necessary for predicting the successful transference of that competency to the 'real world'. Attainment or mastery of a competency provides one with the ability to perform satisfactorily that function in the setting and role from which the competency was derived.

The anasynthesis procedure for model building was used to develop this model (11). Application and simulation were utilized to test the model. Therefore, it can be said that the model is valid and reliable. Continuous revision will be necessary as repeated applications of the model bring necessary changes to the author's attention. These changes will be incorporated by the author as the need arises in order to maintain a high fidelity model.

Application of the model occurred, under the author's direction, in three settings. The first was a training program for special education administrators. The second was a curriculum development project for the education of pharmacists. Third was a curriculum development project with the objective of preparing people oriented practitioners. Application resulted in different program designs although procedures for development were based on the same model.

It was used to design the instruction and delivery system for the Special Education Administration Training Program (SEATP). The project was a joint venture between the Department of Psychoeducational Studies, Special Education Programs and the Department of Educational Administration at the University of Minnesota. It was supported by the Minnesota Department of Education, Special Education Section and by a grant from the Bureau of Education for the Handicapped, USOE. The program was designed to meet simultaneously the current pressing need for trained special education administrators in Minnesota, and to serve as a model that can be replicated in training administrators and practitioners in other areas of human services; e.g., practitioners and administrators of day care centers, group homes, nursing homes, etc.

The second application of the model was for the College of Pharmacy at the University of Minnesota. The purpose was to develop a competency based education program for the preparation of professional pharmacists. The initial activity identified competencies for the practice of professional pharmacy. Accomplishment of that task utilized part of the model. Subsequent development resulted in a General Curriculum Development Model for the College of Pharmacy which serves as the basis for an initial five year curriculum improvement effort.

The third application of the model was to develop a curriculum for the preparation of people-oriented practitioners in pharmacy again in the College of Pharmacy at the University of Minnesota. In this development effort the general model is being applied without development of a specific program model. It was felt by the program staff that the model was specific enough to be implemented directly. If the development effort is judged successful the curriculum will be incorporated in the professional pharmacy curriculum at the College of Pharmacy.

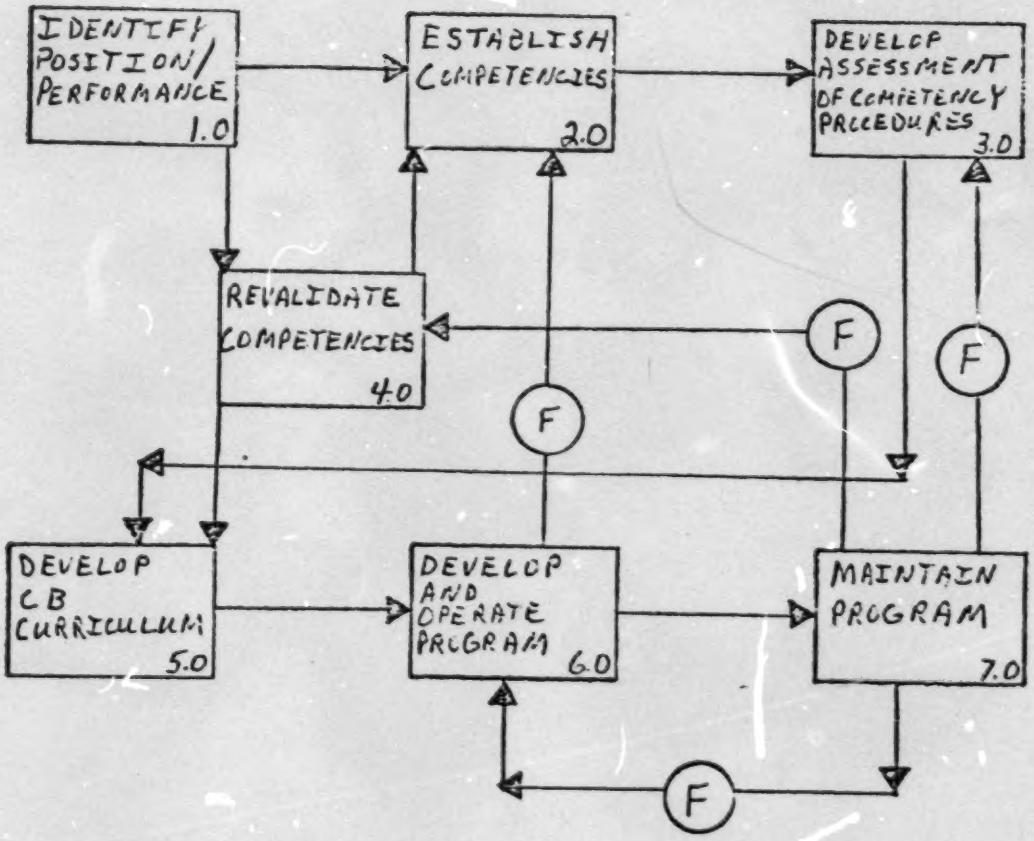
Description of Procedures

Seven procedures comprise the model presented as Figure 1. Those procedures were derived from the literature describing competency based education and instructional design (1)(2)(3)(4)(6)(10)(11)(13)(14). This model takes a hard line with regard

to the rigor presented. It presents leeway concerning the degree of rigor used in an application of the model.

The first procedure (1.0) in Figure 1 results in identification of the position or performance for which instructional development is proposed and the decision on whether such development is appropriate or should be aborted. Once the position or performance has been identified and the decision on continuation is positive, competencies and performance levels are identified as procedure (2.0). Revalidation of competencies (4.0) occurs when feedback from the maintenance of curriculum procedure (7.0) identifies a need. Assessment procedures (3.0) are developed for measurement of the competencies as an attribute of an individual. Almost concurrently, curriculum is developed (5.0) and tested using the assessment procedures (3.0) to measure attainment of the competencies by those completing the curriculum. Concurrently, a curriculum delivery and operation procedure (6.0) is developed. This operational planning is implemented and modified as experience and performance directs. Feedback from pilot testing and implementation of instruction directs attention to competencies with an inappropriate criteria level or instruction. When the program is operating a strategy for maintaining it is implemented (7.0). This procedure provides feedback for operation

Figure 1



General Model of Competency Based Curriculum Development	
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in (6.0), assessment modification in (3.0), and the revalidation of competencies in (4.0). Program maintenance is considered by the author to be the "heart" of the model which insures curricular viability.

Subprocedures in the Model

Referring to Table 1, within (1.0), there is first a need to identify the position or performance (1.1) for which instructional development is considered. It is important to determine if the performance is already established (1.2). In either case the role (1.3) and setting or location (1.4) for performance must be identified (1.5). Assuming the position or performance is displayed by individuals, such persons must be identified (1.5). Lastly, before further development a decision needs to be made relative to continuation, (1.6). Feedback from that decision (1.6) determines if the position or performance is to have competencies developed or the procedure terminates with identification of persons in the position or exhibiting the performance (1.6).

Competencies are next established in (2.0). This consists of four subprocedures: identification of potential competencies (2.1); validation and evaluation of competencies (2.2); establishment of criterion (2.3); and stating the competencies and their performance criteria (2.4). There is some leeway concerning methodology used

Table 1

Model SubProcedures

1.0 IDENTIFY POSITION / PERFORMANCE FOR INSTRUCTIONAL DEVELOPMENT

- 1.1 Identify Position/Performance Title
- 1.2 Determine Position/Performance Established
- 1.3 Identify Role for Position/Performance
- 1.4 Determine location Position/Performance
- 1.5 Identify Present Performance/Position Holders
- 1.6 Program Development Desired Necessary Terminate/Proceed

2.0 ESTABLISH COMPETENCIES

- 2.1 Identify Potential Competencies
  - 2.1.1 Determine Should or Must Question
  - 2.1.2 Perform Goal Analysis
- 2.2 Validate and Evaluate Competencies
  - 2.2.1 Perform Job/Human Activity Anaylsis
  - 2.2.2 Conduct Anthropological Study/Case Study
  - 2.2.3 Perform Survey of Competency Value
  - 2.2.4 Determine Support for Competencies
  - 2.2.5 Classify by Support and Type
- 2.3 Establish Criteria
  - 2.3.1 Determine Performance Must or Should
  - 2.3.2 Determine Acceptable Desirable Performance
  - 2.3.3 Determine Necessary Expected Desirable Performance
  - 2.3.4 Determine Actual Performance
  - 2.3.5 Establish Range or Standard
  - 2.3.6 Modify Based on Performance
- 2.4 State and Clarify Competency and Criteria

3.0 Develop Assessment of Competency Procedures

- 3.1 Develop Content Test
- 3.2 Develop Performance Assessment
- 3.3 Develop Procedures for Using

4.0 Revalidate Competencies

- 4.1 Prepare Revalidation Plan
- 4.2 Conduct Job/Human Activity Anaylysis
- 4.3 Conduct Survey Competency Important
- 4.4 Perform Content Analysis
- 4.5 Compare with Previously Identified Competencies
- 4.6 Modify Competency Content as Necessary

5.0 Develop Competency Based Curriculum

- 5.1 Perform Competency Content Analysis on Competencies
- 5.2 Determine If Instruction Exists
- 5.3 Apply Psychology of Learning
  - 5.3.1 Select Strategy
  - 5.3.2 Select Media
  - 5.3.3 Formulate Application of Learning Psychology
  - 5.3.4 Plan Instruction
- 5.4 Develop Instructional Assessment Procedures
- 5.5 Field Test Instruction
- 5.6 Prepare appropriate Quanity Instruction/Assessment

6.0 Develop and Operate Program

- 6.1 Develop Program Delivery System
  - 6.1.1 Obtain Description Student Population
  - 6.1.2 Obtain Population/Decision Maker Concern/Constraints

6.1.3 Propose/Liscuss Delivery System

6.1.4 Accept Program Delivery System

6.2 Operate Instructional and Delivery Systems

6.2.1 Identify Participants

6.2.2 Provide Adaquate Resources

6.2.3 Assess Participants Instructional Needs

6.2.4 Instruct Participants

6.2.5 Endorse Verified Competency

7.0 Maintain Competency Based Curriculum

7.1 Monitor Competencies Content For Change

7.2 Compare Number Completing With Goal

7.3 Evaluate Achievement of Program Goals

7.4 Recommend Appropriate Changes In Program

7.5 Evaluate Long/Short Term Graduate Performance

7.6 Program Needed Terminate/Continue

Note - This model assumes the reader has a basic understanding of general systems theory and systems modeling.

at each stage but it is important to utilize all subprocedures for compentency identification. Information describing the performance or position for which competencies are to be formulated is the basis for a 'should' or 'must' (see Footnotes) question (2.1.1). This is akin to identifying an analysis or synthesis approach (11). The typical effort has a little of both. The information is used to formulate appropriate goal analysis procedures in (2.1.2) (6), which are utilized to develop a set of potential competency statements which lack validation evaluation.

Those statements from (2.1.2) are validated and evaluated in (2.2) utilizing what the author calls a multiple data point method compiled of three methodologies: human activity/job analysis (2.2.1) (11,12), an anthropological type study/case study (2.2.1) (2,14), and a survey (2.2.3) (13). Inputs from (4.6) to (2.2.1, 2.2.2, 2.2.3) will be explained when discussing (4.6). This information (2.2.1, 2.2.2, 2.2.3) is reported to assertain support for the individual competency statements (2.2.4). It is reported by the class/type and amount of support (three, any two, any one, or no support) offered each competency (2.2.5). Procedures within each subprocedure are selected dependent on the type of statements one desires to make and are relative to the methodology utilized (3).

Criteria for performance is established in (2.3). The competency is classified as a 'should' or 'must' (2.3.1) with reference to it being displayed by present position/performers. 'Must' is the current standard of practice and 'should' is what interest groups would like it to be. No assign-

ment of relative merit is assigned by the labels applied. Each competency is examined to determine expected or necessary desirable performance (2.3.3). Actual performance of position holders/performers is identified if people display that competency (2.3.4). The acceptable desirable performance is determined (2.3.2). This is done to establish a range of performance or standard for each competency (2.3.5) and anyone performing within that range is judged competent. This range is continually modified in (2.3.6) through feedback from (7.4) as further evidence to support various criteria levels is obtained from performance. Feedback from (6.2.4) to (2.3.6) controls modification of criteria based upon ability of students to achieve competencies at various criteria levels on instruction. It is affected by the number of successes desired in "real life" display of the competencies.

Provision of openness and public display of the competencies trageted by these procedures is accomplished through statements accompanied by criteria in (2.4) (4). Because the criteria are constantly changing, such lists are separated. This facilitates revisions and tends to encourage modification.

Determination of individuals who possess a particular competency is achieved in (3.0). Competency statements with accompanying criteria are the basis for content (3.1) and performance (3.2) assessments. The overlap between content and performance tests may be substantial. Nevertheless, the key is performance (3.2) and the content test (3.1) is directed at measuring the content necessary to achieve the performance. To achieve the appropriate level of content coverage the content assessment (3.1) is provided standards

of acceptable performance from the achievement of the performance measured by the performanc assessment (3.2). A higher or lower cutoff is set based upon achievement of performance both in assessment (3.0) and over time in the maintenance subsystem (7.0). The assessment center concept is used by the author for performance assessment (see Footnote 2). Procedures for utilizing assessment procedures are developed (3.5) which include test administration procedures, reporting methods, and timing within the overall educational endeavor.

Concurrent with development of assessment of competency procedures (3.0) is curriculum development (5.0). First, a competency content analysis (5.1) is performed on each competency for which a program is being developed (see Footnote). Next, the existence of instructional programs (5.2) directed at the same or similar content and population is determined. While previously developed programs may not be completely congruous with the current objectives/ needs they might provide a base for development. These experiences, procedures, and materials may provide direction to the development of instructional assessment and curriculum thereby making the present effort more efficient. This may lead to the outright adoption or adaptation of all or portions of a previously developed program. That would result in a field test (5.5) of the instruction with necessary revisions being made to achieve the instructional objectives. In most cases, application of the psychology of learning for instructional design (5.2) will probably occur. This consists of selecting the media of instruction (5.3.2), appropriate instructional strategies (5.3.1),

formulating applied psychology of learning (5.3.3), and integrating it all in planning instruction (5.3.4). This process relies on input from (5.3.1), (5.3.2), (5.3.3.) and the program delivery system (6.1.4) culminating in development of a plan for instruction (5.3.4) which includes production of materials when the plan is field tested in (5.7), (5.3.4) imputs (5.4) for development of instructional assessment procedures. Instruction is field tested (5.5) with the brightest members of the participant population (6.2.1). Initially this tryout is conducted on a one-to-one basis as each instructional component is completed. The final field test is the full-scale tryout prior to final implementation (6.2.4) (2). Once the curriculum is judged to achieve its objectives the necessary quantities of materials are secured (5.6) for operating the program.

While the curriculum is being developed in (5.0) the program delivery system (6.1) is being developed. The delivery system (6.1.4) provides input into the ultimate instructional design (5.3.4) and this inputs testing (5.4). Events leading to the description of student population characteristics (6.1.1) allowing decision-makers to utilize student information in identifying concerns and constraints (6.1.2). Based on limitations and experience derived from field testing (5.4) and subsequently as feedback from program operation recommendations (7.4), delivery subsystems are discussed (6.1.3). Ultimately the delivery system is accepted (6.1.4) and modification occurs periodically based on recommendations from program maintenance (7.6). This signals readiness for operating the instruction and delivery systems (6.2). Participants

are identified (6.2.1) and their individual instructional needs are assessed (6.2.3). Specific needs identified provide feedback control for the quantity and type of instructional resources in (6.2.2). The assessment in (6.2.3) also controls the instruction provided participants in (6.2.4). In some cases, the individual may be endorsed for part or all instructional objectives and/or competencies in (6.2.5) without participation in the instructional program (6.2.4). Normally the occurrence after (6.2.3) assessment will provide instruction first (6.2.4) and then competency assessment with endorsement (6.2.6) of all or part of the competencies attained. Participants continue in the cycle instruction (6.2.4), assessment (6.2.3), endorsement (6.2.5) until all competencies or at least the desired competencies are endorses (6.2.5). During this process data is collected in (6.2.3) which through feedback may modify the competency criteria (2.3.6), the delivery system (6.1.4), instruction (5.3.4), content analysis (5.1), and/or competency assessment procedures (3.0).

When people are involved in any procedure of the model information exists for collection and analysis. Collection and use of this information is the function of the maintenance procedure (7.0). Its purpose is to provide feedback to control key procedures thereby keeping the total Competency Based Curriculum on target. In addition to receiving the output of the assessment of instructional needs (6.2.3), instruction (6.2.4), and endorsement (6.2.5) the maintenance procedure (7.0) also receives information on the goals of the program concerning the performance or position education is directed toward

(1.1), the competency statements and criteria (2.4), the analysis of content of each competency (5.1), and the delivery system constraints (6.1.2). Information on instruction and delivery system performance (6.2.4), (6.2.5) is compared with the criteria (1.1), (2.4), (5.1) to determine changes in competencies and/or content in (7.1). The number of students completing the program and achieving competency is compared with the goal for percent completing successfully (6.1.2) in (7.2) and (7.4).

Achievement of program goals (7.3) is evaluated with input provided from the assessment of the long and short term performance of graduates (7.5). All preceding information and evaluations are reviewed to recommend appropriate changes in the program (7.4). Such application of learning psychology (5.3), competency content analysis (5.1) and/or signal the need for revalidation of competencies (4.2) and reconsideration of competency criteria (2.3.5) or the competency assessment procedures (3.0). The specific recommendations will affect the system to result in attainment of education program goals both broadly and specifically. Another option is available; program termination in (7.6). Though rarely implemented that option is important. Perhaps more existing programs should consider program termination (7.6) as a means of clearing the educational community of ineffective instruction.

Based upon the functioning of graduates in real-life performance and/or changes in the field which revise competencies, a method is developed to revalidate competencies (4.0). This is important as it provides continuous review and possible revision (deletion, addition or modification) of competency

statements (4.6). The procedures in (4.0) consist of a small scale validation and evaluation study similar to (2.2). Components include conducting a job/human activity analysis (4.2), survey of importance (4.3), and when the change is mainly content compentency content analysis in (4.4). Specific methodology is determined in (4.0), similar to (2.0), by the statements desired to be made concerning competency and/or content objectives. This yields information used to compare already identified competencies (2.4) with the revalidation study findings in (4.5). Any change recommended in (4.6) will provide input for competency content analysis in (5.1) and the validation and evaluation subprocedures (2.2.1), (2.2.2), (2.2.3).

The relevance of this model is in its applicability and the users ability to utilize it for problem solving. Since the model has been applied successfully in three different situations of competency based curriculum development, it is ready to be applied to other real-life educational problems. Enablement of readers to apply this model to their own situations and their ability to use it for problem solving is a goal of this paper.

FOOTNOTES

1. "Must have" competencies are those behaviors, skills, and knowledge necessary for performing a specific role function with reference to a specified environment. If any "must have" competency were not present the individual would be considered as not performing the specific role function in the environment. These are the competencies which are most generic to a profession. "Should have" competencies are those which relate to the more, progressive or desirable but not as yet a current standard of practice, these may not be necessary to perform proficiently today, but may be necessary tomorrow. These are least like the generic performance of general standard or practice.

2. Assessment Center: Assessment centers are more a methodology rather than a physical entity. There purpose is to predict the probable successful performance of an individual in a real world environment relative to validated competencies. Assessment procedures utilize simulation of the real world environment based on work samples to assess a person's performance on the competencies. The assessment procedures consist of multiple measurement techniques utilizing multiple independent objective observations of behavior by individuals and data collection instruments. Possible work sampling techniques aimed at measuring competency performance include simulations, role-playing, gaming, situational problem-solving, and other techniques aimed at measuring performance specified in the competency. Evaluative judgments are based on a comparison of an individual's performance, as reported by the observers, with the cirteria for acceptable performance.

   (as revised by the Curriculum Improvement Office 2/24/76)

3. Competency Content Analysis: Breaking down overall competency into component parts of necessary knowledge, tasks, skills, and attitudes to achieve the competency.

   a. Knowledge is the information and understanding of the information necessary to perform a task. Two types of information include immediate recall without references and that available through the use of references. Examples might include: Name a class of drugs, and describe the general characteristics of the class.
   b. Task is the selection and application of the information to a specific problem. Example: Calculation, estimation, selection.
   c. Skill includes information, understanding of the information, and the cognitive ability to apply the information. The individual is also able to combine manipulative functions such as titration, compounding, and purpose of dosage; consultation with patient.
   d. Attitudes influence choices in which the individual indicates his professional values through their chocie of action. Examples might include follows prescribed standards of safety; intervention in cases of contraindication in drug therapy; judgments of drug quality during the procurement process.

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